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REPORT OF THE SECRETARY OF THE BOARD OF EDUCATION ON THE SUBJECT OF SCHOOLHOUSES, SUPPLEMENTARY TO HIS FIRST ANNUAL REPORT.

(Continued from our last Number.)

THE common, or atmospheric, air, consists, mainly, of two ingredients, one only of which is endued by the Creator with the power of sustaining animal life. The same part of the air supports life and sustains combustion; so that in wells or cellars, where a candle will go out, a man will die. The vital ingredient, which is called *oxygen*, constitutes only about twenty-one parts in a hundred of the air. The other principal ingredient, called *azote*, will not sustain life. This proportion is adapted, by omniscient wisdom, with perfect exactness, to the necessities of the world. Were there any material diminution of the oxygen, other things remaining the same, every breathing thing would languish, and waste, and perish. Were there much more of it, it would stimulate the system, accelerating every bodily and mental operation, so that the most vigorous man would wear out in a few weeks or days. This will be readily understood, by all who have witnessed the effects of breathing exhilarating gas, which is nothing but this oxygen or vital portion of the air, sorted out and existing in a pure state. Besides, this oxygen is the supporter of combustion, and, were its quantity greatly increased, fire would hardly be extinguishable, even by water. But the vital and the non-vital parts of the air are wisely mingled in the exact proportions, best fitted for human utility and enjoyment; and all our duty is not to disturb these proportions. About four parts of the twenty-one of vital air are destroyed at every breath; so that, if one were to breathe the same air four or five times over, he would substantially exhaust the life-giving principle in it, and his bodily functions would convulse for a moment, and then stop. As the blood and the air meet each other in the lungs, not only is a part of the vital air destroyed, but a poisonous ingredient is generated. This poison constitutes about three parts in a hundred of the breath thrown out from the lungs. Nor is it a weak, slow poison, but one of fatal virulence and sudden action. If the poisonous parts be not regularly removed, (and they can be removed only by inhaling fresh air,) the blood absorbs them, and carries them back into the system. Just according to the quantity of poison, forced back into the blood, follow the consequences of lassitude, faintness, or death. The poisonous parts are called carbonic acid. They are heavier than the common air, and as the lungs throw them out at the lips, their tendency is to fall towards the ground or the floor of a room, and if there were no currents of the air, they would do so. But the other parts of the air, being warmed in the lungs and rarified, are lighter than the common air, and the moment they pass from the lips, their tendency is to rise upward towards the sky. Were these different portions of the air, as they come from the lungs, of different colors, we should, if in a perfectly still atmosphere, see the stream divided, part of it falling and part ascending. A circulation of the air, however, produced, out-of-doors by differences of temperature, and in our apartments by the motion of their

occupants and by other causes, keeps the poisonous parts of the air, to some extent, mingled with the rest of it, and creates the necessity of occasionally changing the whole. Though the different portions of the air have the same color to the bodily eye, yet in the eye of reason their qualities are diametrically opposite.

Although there is but the slightest interval between one act of breathing and another, yet, in a natural state of things, before we can draw a second breath, the air of the first is far beyond our reach, and never returns, until it has gone the circuit of nature and been renovated. Such are the silent and sublime operations, going on day and night, without intermission, all round the globe, for all the myriads of breathing creatures that inhabit it, without their notice or consciousness. But, perhaps some will suppose, that, in this way, the vital portion of the air, in process of time, will be wholly consumed or used up; or that the poisonous portion, thrown off from the lungs, will settle and accumulate, upon the earth's surface, and rise around us, like a flood of water, so high as eventually to flow back into the lungs and inflict death. All this may be done; not however in the course of nature, but only by suicidal or murderous contrivances. In the Black Hole of Calcutta, in the year 1756, one hundred and forty-six persons were confined to a room only eighteen feet square for ten hours; and although there was one aperture for the admission of air and light, one hundred and twenty-three had perished at the end of that time. Only twenty-three survived, and several of these were immediately seized with the typhus fever. In the Dublin Hospital, during the four years preceding 1785, out of seven thousand six hundred and fifty children, two thousand nine hundred and forty-four died, within a fortnight after their birth; that is, thirty-eight out of every hundred. The cause of this almost unexampled mortality was suspected by Dr. Clarke, the physician, who caused fresh air to be introduced by means of pipes, and during the three following years, the deaths were only one hundred and sixty-five out of four thousand two hundred and forty-three, or less than four in a hundred; that is, a diminution in the proportion of deaths of more than thirty-four per cent. Hence it appears, that, through a deficiency of pure air, in one hospital, during the space of four years, there perished more than twenty-six hundred children. In Naples, Italy, there is a grotto, where carbonic acid issues from the earth and flows along the bottom in a shallow stream. Dogs are kept by the guides who conduct travellers to see this natural curiosity, and, for a small fee, they thrust the noses of the dogs into the gas. The consequence is, that the dogs are immediately seized with convulsions, and, if not released, they die in five minutes. But let us not cry, *Shame!* too soon on those who are guilty of this sordidness and cruelty. We are repeating every day, though in rather a milder fashion, the same experiment, except that we use children instead of dogs.

But why, in process of time, it may still be asked, is not the vital principle of the air wholly exhausted, and the valleys and plains of the earth, at least, filled with the fatal one? Again, Divine Wisdom has met the exigency in a manner fitted to excite our admiration and wonder. The vegetable world requires for its growth the very substance which the animal world rejects as its death; and in its turn, all vegetable growth yields a portion of oxygen for the support of animal life. One flourishes upon that which is fatal to the other. Thus the equilibrium is for ever restored; or rather it is never disturbed. They exchange poison for aliment; death for life; and the elements of a healthful existence flow round in a circle for ever. The deadly poison thrown from the lungs of the inhabitants of our latitudes, in the depths of winter, is borne in the great circuit of the atmosphere to the tropical regions, and is there converted into vegetable growth; while the oxygen, exhaled in the processes of tropical vegetation, mounts the same car of the winds, and, in its appointed time, revisits

the higher latitudes.* Why should we violently invade this beautiful arrangement of Providence?

There is another fact, impossible to be overlooked in considering this subject. Who can form any just conception of the quantity of air, which has been created? Science has demonstrated, that it is poured out between forty and fifty miles deep all round the globe. It was to prevent the necessity of our using it, *second-hand*, that it was given to us by sky-fulls. Then, again, it is more liquid than water. It rushes into every nook and crevice, and fills every unoccupied place upon the earth's surface. All the powers of art fail in wholly excluding it from any given space. We cannot put our organs of breathing, where some of it will not reach them. All we can do is to corrupt it, so that none but fatal or noxious air shall reach them. This we do. Now if the air were a product of human pains-taking; if laborers sweated or slaves groaned to prepare it; if it were transported by human toil from clime to clime, like articles of export and import, between foreign countries, at a risk of property and life; if there were ever any dearth, or scarcity of it; if its whole mass could be monopolized, or were subject to accident or conquest, then, economy might be commendable. But ours is a parsimony of the inexhaustible. We are prodigals of health, of which we have so little, and niggards of air, of which we have so much. In the State Lunatic Hospital at Worcester, there are eight hundred feet cubic measure to each apartment, for one patient only. In the Prison at Charlestown, one hundred and seventy-one and a half cubic feet are allowed to each prisoner's cell. In addition to this, free ingress and egress of the air is allowed, by means of apertures and flues in the walls. In the Penitentiary, erected at Philadelphia a few years since, thirteen hundred cubic feet were allowed to each prisoner, solitarily confined; while in some of our schoolrooms, less than forty cubic feet is allowed to a scholar, without any proper means of ventilation; and in one case, a school has been constantly kept, for thirteen years, in a room which allows less than thirty feet of air to the average number of scholars, now attending it; and even this schoolroom, contracted as it is, is besieged by such offensive effluvia, that the windows are scarcely opened, even in summer.

I know of but three causes, which can have led to these opprobrious results. In populous and crowded places, the price of land may have been thought to justify the use of small rooms for many scholars. But this can never have been even a pecuniary argument of any weight with a financial mind; for the ultimate public expense of the sickness and poverty engendered, would overbalance, a thousand fold, the requisite original outlay. Besides, even if there were limit and constraint horizontally, there can have been none perpendicularly.

A motive of some efficacy may have been felt in the increased expense of erecting a house of adequate size. This is a tangible motive. But how feeble is it, when compared with the health and comfort of children, their love of study, and their consequent proficiency in it! Should a case of necessity actually arise, where children were obliged to undergo some privation, far better would it be to stint them in their clothes, their food, or their fuel, than in their air. But in regard to schoolhouses which are built at the public expense, such a necessity never can occur. Besides, these considerations affect size only, not ventilation.

An economy of the air, which has once been warmed, is the only remaining motive for using foul air. But if the warm air is saved, the foul air must be breathed; for they are the same. For several years past, high ceilings have been strenuously recommended as a compromise of the difficulty. But when the room is high, it is necessary, in the first place, to warm a much greater quantity of air, than is required for breathing, and when it has all been once breathed, it becomes as necessary to remove it and supply its place with pure air, as though the quantity had been small.

* See Appendix A. and B.

Besides, pure air at a lower temperature will warm the human system more, than impure air at a higher. In our climate, a moderately low ceiling is preferable to a high one, because, with such, a much larger portion of the air which we have been at the expense to heat, can be used.

But it is believed, that, in the vast majority of cases, this habitual use of foul air is not the result of calculation, but of oversight. And it is worthy of especial attention, that many of our schoolrooms, where the greatest privation of healthful air is now suffered, were constructed originally with a large open fireplace, which was of itself a sufficient ventilator; and that afterwards close stoves were introduced to overcome the coldness of the rooms, without any reflection, that what was gained in warmth and comfort, was lost in the purity of the atmosphere, and consequently in bodily health and mental vigor.

In regard to this most immediate of all the necessaries of life, that arrangement would be perfect, which should introduce the life-sustaining air, just as fast as it should be wanted for breathing; and, when breathed, should carry it off, not to be breathed again, until it should be renovated and purified in the laboratory of Nature. If one washes himself in running water, he will never dip up the same water a second time. So should it be with the air we respire. An arrangement, producing this effect, is perfectly practicable and easy. By examining a most valuable communication, placed at the end of this report, from Dr. Woodward, the Superintendent of the Lunatic Hospital at Worcester, it will appear, that fifty persons will consume the entire body of air in a room, thirty feet square and nine feet high, in about forty minutes. If, however, the room be perfectly tight, the air, once respired, will be partially mingled with the whole mass of air in the room, and will offer itself to be breathed again. What is wanted, therefore, is a current of fresh air flowing into the room, while a current of the respired air flows out of it; both to be equal to the quantity required for the occupants. Under such circumstances, if there be but little motion in the room, the poisonous part of the air will settle towards the floor as soon as it is cast from the lungs, while the other part of it, being raised almost to a blood heat in the lungs, will rise to the ceiling. In the ceiling, therefore, should be an aperture for its escape. The carbonic acid will tend to flow out under the door or when it is opened. If the ceiling be concave or dome-shaped, only one aperture will be necessary;—if horizontal, and the room be large, several may be required. The number will depend upon the manner in which the room is heated. If the house be of one story only, the apertures will open into the attic. On the upper side of the aperture let a trap-door be hung, to be raised by a cord, running over a pulley, and coming down into the room, or, (which is more simple,) by wires, after the manner of house-bells. This door should be prevented from opening to a greater angle than eighty degrees, so that when the cord is loosened it will fall by its own weight and close the orifice. The door will be opened, more or less, according to the temperature of the weather and the degree of wind prevailing without, so as always to carry off the impure air just as fast as it is fouled by the lungs. Any person, by stepping into the open air and inhaling it for half a minute, can, on returning into the room, determine the state of the air within it. If the apertures through the ceiling open into the attic, the air can be let off, either through fan-windows at the ends, or through sky-lights; or an opening can be made into the chimney and a flue carried up to its top. In the last case, the floor of the attic, immediately under the flue, should be plastered, or covered with something incombustible, to make it perfectly secure against cinders, coming down through the flue. If the building be two stories high, the apertures for ventilation in the lower story, instead of being in the upper ceiling of the room, should be in the side walls, next the ceiling, and so ascend, by flues, through the walls of the second story until they

open into the attic. Sliding dampers can be used, in order to open or close these lower orifices, so as to regulate the escape of air from the room. Where a schoolhouse two stories in height has been built in disregard of the laws of health and life, the lower room may be ventilated by making apertures in its upper ceiling, next to the walls of the room, and carrying up flues through the second story in tight boxes, attached to the walls and opening into the attic through similar apertures in the upper ceiling of the second story. These boxes will appear, in the second story, to be only casings of posts or pilasters, and will not materially disfigure the room.

The best apparatus for expelling foul air from a room consists in the proper means of introducing a supply of fresh warm air. Undoubtedly, the best mode of warming a room is to have a cellar under it, and to place a furnace in the cellar. Some place of storing wood seems indispensable for every schoolhouse, and a cellar could ordinarily be dug and stoned as cheaply as a wood-house could be built. I suppose, also, that a schoolhouse would be much less exposed to take fire from a furnace well set, than from a common fireplace or stove. But the great advantage of warming by a furnace is, that all parts of the room are kept at the same temperature. The air presses outward instead of inward, through every crack and crevice in door or window. No scholars are injured by being forced to sit in the vicinity of a stove or fireplace ; nor is any part of the room encumbered by either. When the latter are used, many scholars, who sit in exposed situations, will spend half an hour a day, and often more, in going to the fire to warm themselves ; and, in addition to those, whose comfort requires them to go, idlers, from all sides of the house, will make it a rendezvous or halfway place, for visiting. With an unequal diffusion of heat in a school warmed by a stove, or fireplace, I believe it is always true, that diligent scholars will stay in their seats and suffer, while the lazy will go to the fire to drone. Some other advantages of setting a furnace in a cellar to warm a school, are mentioned in the excellent communication of Dr. Woodward, above referred to. Feet can be warmed or dried at the orifices for admitting the heated air from a furnace as well as at a stove. There may be two of these orifices, one for the boys and one for the girls. The setting of a furnace requires some skill and science. We often meet with a prejudice against furnaces, which belongs not to the furnaces themselves, but to the ignorance of those who set them. There seems to be no objection, except it be that of appearance, against setting the furnace so high in the cellar, as that its brick or soapstone top shall be on a level with the floor of the room, and constitute a part of it.

If a common stove must be used for warming the room, then let it be enclosed in a case of sheet iron, rising from the floor on three sides of the stove and bending over it ; not, however, so as to *close* over its top, but leaving an opening in the case, greater or less, according to the size of the stove and of the room. The sides of the case should be two or three inches from the sides of the stove. The stove should stand on legs a few inches from the floor, and fresh air should be introduced from out-of-doors and conducted under the stove in a tube or trough, which, as it rises around the stove, will be warmed and enter the room through the opening in the case at the top. A slide in the tube or trough will regulate the quantity of air to be admitted. The sensations, experienced in a room into which the external air is directly introduced and warmed in its passage, belong to a class entirely distinct from those engendered by air warmed in the ordinary way. They will be grateful to the pupils, and will promote elasticity and vigor of mind. It would be well to place the stove directly in the current of air caused by opening the door.

The common expedient of letting down windows from the top, so that the noxious air may escape, and the vacuum be filled with the pure, accomplishes the object in a very imperfect, and, at the same time, an objec-

tionable manner. If there be any wind abroad, or, if there be a great difference in temperature, between the external air and the air of the room, the former rushes in with great violence and mingles with the heated and corrupted air, so that unless several room-fulls of air be admitted, a portion of that which has been rendered unfit for use, will still remain, while some that has been partially warmed will escape. But the greatest objection is, that the cold air drops like a shower-bath upon the scholars' heads ;—a mode which all agree in pronouncing unhealthful, and sometimes dangerous.

Some schoolrooms are heated by a common close stove, the front part of which is placed in the wall, so that the door, where the stove is filled, is in an entry, while the body of the stove is in the schoolroom. It depends on other circumstances, whether this arrangement is beneficial or injurious. Where the air which keeps up the fire in the stove is taken from an entry, it passes through the funnel and chimney, and leaves the body of air in the room unchanged. This is no objection, provided the air in the room is changed otherwise. But if no other provision is made for changing the air in the room, the draught of the stove becomes important for that purpose. And although this may involve the evil of drawing in just as much air, through the crevices and openings, as is carried off through the stove, yet it is a less evil, than that of stagnant air in the room. If, however, the room is warmed by introducing a current of air from without, which is heated in its passage, then the arrangement of feeding the stove in an entry is unobjectionable, and may, often, be very commodious.

If the room be so warmed that the air presses from within, outwards, the doors should be hung so as to open inwards ; if, on the other hand, the room be warmed by a common stove or fireplace, the external air will press inwards, and therefore the doors should be hung so as to open outwards. Where the schoolroom has been so faultily constructed, that a current of air blows directly upon a row of scholars, every time the door is opened, the door should be re-hung, or have a spring to prevent its being left open.

A thermometer should be kept in every schoolroom, and hung on the coolest side of it. The proper temperature should be determined by unchangeable laws ; not by the variable feelings or caprice of any individual. Without a thermometer,—if the teacher be habituated to live in the open air ; if he be healthy, vigorous, and young ; if he walk a mile or several miles to school ; and especially, if he keep upon his feet during school hours ;—the scholars will be drilled and scolded into a resignation to great suffering from cold. If, on the other hand, the teacher lead a sedentary life ; if his health be feeble ; if he step into the schoolroom from a neighboring door, he will, perhaps unconsciously, create an artificial summer about himself, and subject the children to a perilous transition in temperature, whenever they leave his tropical regions. In this way, a child's lungs may get a wound in early life, which neither Cuba nor the South of France can ever afterwards heal. A selfish or inconsiderate master will burn a whole room-full of children during the chill, and freeze them during the fever, of his own ague-fits. They must parch or congeal, as he shivers or glows.

It should be remembered, also, that even the thermometer ceases to be a guide, except in pure air. When pure air enters the lungs it evolves heat. Its oxygen carries on the process, (supposed to be combustion,) necessary for that purpose. This keeps our bodies warm. It is the reason why the blood remains regularly at a temperature of ninety-eight degrees, though the air by which we are surrounded rises to that heat but few times in a year. The air constantly supplies to the body, through the medium of the lungs, the heat which it is constantly abstracting by contact with its surface. But it is only through the agency of the oxygen, or life-sustaining portion of the air, that this heat is supplied. A thermometer, however, is insensible to this difference. It will indicate the same degree of heat in azote, i. e., in that portion of the air which will not sustain life, as in oxygen ;

although a man immersed in azote at seventy or eighty degrees would die of cold, if he did not of suffocation. I reiterate the first position, therefore, that even a thermometer ceases to be a guide, except in pure air.

Ordinarily, we can undergo a change of a few degrees in temperature, without danger or serious inconvenience; but there is a limit, beyond which the change becomes perilous and even fatal. Suppose in a school, having a winter term of only four months, and consisting of but fifty scholars, one quarter of an hour in a day, on an average, is lost for all purposes of study, in consequence of the too great heat or cold of the room; the aggregate loss, allowing six hours to a day, will be two hundred days, or more than eight months. And yet, in many of our schools, half the day, for all purposes of improvement, is, by this cause alone, substantially lost.

Every keeper of a green-house regulates its heat by a thermometer. The northern blasts which come down upon the blossoms of a farmer's orchard or garden, chill him as much as them. When shall we apply the same measure of wisdom to the welfare of children as to that of fruits and vegetables! I am told by physicians, that from sixty-five to seventy degrees is a proper temperature for a room. Something, however, must depend upon the habits of the children. In cities, there is generally less exposure to cold, than in the country; and factory children would suffer from cold, when those employed in the out-door occupations of agriculture would be comfortably warm.*

* We give below two letters, one from COL. JENKINS, an experienced architect in the City of Boston, the other from DR. WOODWARD, the Superintendent of the State Lunatic Hospital at Worcester, on the subject of the construction of schoolhouses. The suggestions will be found very important. Though published in the 8th No. of our Journal, we deem them worthy of a reinsertion here.—ED.

"*Boston, Jan.* 21, 1839.

"Dear Sir,—Your favor of the 19th is just received. In answer to your question, 'whether it is a healthful way of finishing rooms, to plaster them upon a solid brick wall, without furring,' I think, in a word, that it is *not*.

"It is almost, perhaps quite, impossible that walls will not be penetrated by water, and conduct it through to the inner surface; some expedients have been adopted, in order to obviate this evil—as in prisons and hospitals, where it is unsafe to attach any finish to the walls, which could be removed by the inmates, and made the instruments of mischief in their hands. One method has been, to construct the walls with an interstice, or separation in the wall, between the outer and inner courses of the brick-work, when made of brick, and on the same principle when of stone. The objections to this are obvious. Unless the walls are made much thicker than otherwise necessary, their strength is materially lessened, and their liability to be penetrated by the weather proportionably increased. The outer and inner parts of the wall must be banded together by separate stones or bricks, which, in themselves, are conductors of moisture; the vacuum also is liable to be filled with rubbish or other nuisances. I suppose your inquiry has reference more especially to schoolrooms, and you will permit me to remark, that walls plastered upon the brick-work, without furring, are not only liable to dampness, but always cold, and, next to iron or marble, conductors of heat. Now, the youth in school are always allowed, and much enjoy and improve, recesses for play and exercise; they return to their studies, glowing with a brisk circulation of vital warmth, and it is clear, if in this state they come in contact with such a wall or any other powerful conductor, a sudden change is produced, and the subject is injured in health. Add to this, the uncomfortableness of such a wall:—it is also cheerless and unpleasant, and nothing of this kind should come in contact with the mental or physical sense of the student. Will you pardon me, sir, if I mention also, though aside from your inquiries, that the proportions and ventilation of schoolrooms are of vast moment to the wellbeing and improvement of the pupil. I think there is native taste in every well-balanced mind, though uneducated; whatever, therefore, is brought in constant contact with that of the learner, should be symmetrical and agreeable.

"The gas which is generated in assemblies of youth, will arise and escape through attic ventilators, while that produced by adults is more dense, and of such a nature as to require apertures below to allow its escape. These last hints are gratuitous, but your efforts in the cause of Education will lead you to favor any auxiliary, however humble.

"I remain, sir, very respectfully, your ob't serv't, J. JENKINS."

"*Worcester, Feb.* 27, 1839.

"Dear Sir,—I received your favor of the 25th instant, in which you propose the inquiry,

SIZE.

The next thing in point of importance in regard to a schoolhouse is its dimensions. In almost every thing heretofore written on this subject, the size of the schoolroom, in proportion to the number of scholars, has been a very leading topic. And, certainly, if there be no special means provided for changing the air in the room, the importance of liberal dimensions cannot be exaggerated. But if, instead of forcing foul air back again and again into the children's lungs, we permit Nature to perform her gratuitous and beneficent labor, by carrying it beyond their reach, as soon as it has once been respired, then one main object of increasing the size of the room is already accomplished. The great end of a supply of healthful air being secured, the dimensions of the room are left to be determined by other considerations. These are, the convenient arrangement of the seats, so that the teacher can survey the whole school with a single look; so that each scholar can have an easy access to his own seat, without disturbing or being disturbed by any other; and so as to remove the temptations to communicate, to play, or to aggress.

In regard to the size of the rooms, it may be observed, generally, that in addition to the room requisite for seats and desks, as described below, there should be an open space all round the walls, at least two feet and a half in width, besides room for common recitations, and for the teacher's desk. Seats may be attached to the walls for the accommodation of visiters, or for the scholars, should it ever be desirable, for any purpose, to arrange them in a continuous line. Movable benches may be provided,—instead of seats fastened to the wall,—to be taken away, when not wanted for use, and so to leave that space entirely unoccupied. Joseph Lancaster, in making arrangements for great numbers of the children of the poor, where cheapness was a main object, allows nine feet area, on the floor, to each scholar. His rooms were fifteen or twenty feet high. If only fifteen feet high, an area of nine feet would give one hundred and thirty-five cubic feet of space to each scholar; and one hundred and thirty-five cubic feet in a room ten feet high, would give to each scholar an area four feet in length and almost three feet and a half in width. Even at this rate, a family of six persons would have a room only about eight feet by ten.

DESKS, SEATS, &c.

It seems to be a very prevalent opinion, at the present day, amongst all

'whether you think it a safe or proper mode of constructing brick buildings, to plaster the inside of the exterior walls, directly upon the bricks, or without furring?'

"Many persons object to brick houses, because they are damp; others think them colder than houses built of wood. The reason for both objections, lies in the fact, that many houses are plastered on the brick walls. If the walls of a brick house are furred or built hollow, they are nearly or quite as dry as a house built of wood, and quite as warm.

"A brick wall, eight inches thick, is rarely so tight as to exclude the external air or the rain in a driving storm, and of course should never be plastered on the inside, but be furred so as to leave a space for air between the wall and plastering. All brick walls, but particularly thick ones, are generally colder than the atmosphere of the rooms, and will transmit the heat so rapidly as to form a condensation of the vapor of the atmosphere upon them, rendering them damp, and this moisture frequently accumulates in such quantity as to be visible in drops and currents upon the wall. Such houses can neither be comfortable nor healthful.

"If the walls of a house are not constructed so as to be hollow, or have a vacant space of an inch or two in the brick-work, they ought to be furred, lathed, and plastered, so as to leave a space for air between the brick and plastering, which makes the house both warmer and drier than it can otherwise be made.

"Some years ago, I was frequently in a very handsome brick house, built at great expense, but the exterior walls were plastered on the brick. It had many occupants, all of whom concurred in the statement, that the house was damp, and that articles of clothing, in closets no way connected with the outer walls of the house, would become mouldy, and spoil, if not attended to frequently; and that all clothing and bedding in rooms not constantly occupied, would be so damp as to be quite unsafe and unfit for use.

"Yours, very truly and affectionately, SAMUEL B. WOODWARD."

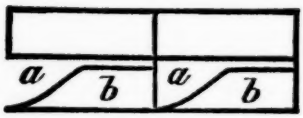
professional teachers, that seats on a horizontal floor, are preferable to those which rise on the sides or at the end of a room, or both, in the form of an amphitheatre. And it is obviously a great fault in the construction of a room, if, when a class is brought upon the floor to recite, the teacher is obliged to turn his back upon the school, when he looks at the class, or upon the class when he looks at the school. A level floor also increases the space for air, and as the room is warmed downwards, it makes the temperature more equable. The seats with desks should be arranged in parallel lines, lengthwise of the room, with aisles between, each seat to accommodate one scholar only. Although it would be better, that they should be movable, yet as this cannot, perhaps, ordinarily be done for district schools, the front side of one seat may be the back of the next in the row. Eighteen inches is, perhaps, a suitable width for the aisles. Each desk should be two feet long, and not less than one foot and six inches wide. A width of one foot and nine inches would be better. In some houses, the seats connected with single desks are one foot square, and are placed behind the middle of the desks ; in others the seats are one foot wide and as long as the desks. It may sometimes be desirable to place two scholars temporarily on the same seat, as for the purpose of reading from the same book. The former arrangement would make this impracticable. The children will sit more easily and more upright, if the back of the seats slope a little from them, at the shoulder-blades ; and also, if the seats themselves incline a little—the front part being a little the highest. The forward part of the desk should be level for about three or four inches. The residue should have a slight inclination. A slope of an inch and a half in a foot would, probably, be sufficient. It should not be so great, as that books and slates would slide off. For the deposit of books, and so forth, there may be a shelf under the desk, or the desk may be a box, with a cover, hung upon hinges for a lid. The first method supersedes the necessity of raising a lid, by which books, pencils, and so forth, are sometimes thrown upon the floor or upon the front neighbor. The shelf, however, is far less convenient, and the contents are liable to be perpetually dropped out. The box and lid, on the whole, seem much preferable, the sloping part of the cover to constitute the lid. For the security of the desks, locks and keys are sometimes used. But the keys will occasionally be lost, by accident ; and sometimes, by bad scholars, on purpose. Besides, what appalling images throng the mind, at the reflection, that the earliest associations of children in regard to the security of property amongst themselves, must be of locks and hiding-places, instead of honesty and justice ! The board which makes the front of one seat and the back of the next, should rise, perhaps a couple of inches, above the level of the horizontal part of the desk, to prevent things from sliding off forwards. Into this horizontal part of the desk, the inkstands may be let : so loosely, however, as to allow of their being taken out to be filled ; and so deep, that their tops will be on a level with the desks. They may be covered, either with a metallic lid, resembling a butt hinge, to rise and fall ; or, which is better, with a common slide, or with a flat circular piece of pewter, having a stem projecting on one side, like the stem of a watch, through which a nail or screw may be driven, not tightly, but so that the cover may be made to slide over or off the orifice of the inkstand, on the nail or screw, as a hinge.

Instead of the form of desks, above described, I have seen some, constructed after the plan of Mr. Alcott's Prize Essay, in which the box or case for the books, and so forth, is in the front part of the desk ; that is, in the horizontal and not the sloping part of the desk above described. They are made about eight inches in width, and deep enough to receive the largest atlases, slates, and writing-books, when placed edgewise, for which purpose, an inch or two on one side of the box is partitioned off. The lid

is hung on hinges, as above described, and when shut forms a part of the desk.*

Last year, a gentleman in Hartford, Conn., offered a handsome premium for the best form of a desk for schools. Several plans were submitted to the judges, selected to award the premium. They decided in favor of a desk, designed to accommodate two scholars, upon one seat. The desk was a tight box, without any lid, but having an oblong opening, *at each end*, large enough to admit books, slates, &c. In this way, whatever was put in or taken out of the desk would be exposed to the view of the teacher and scholars.

The edge of the desk and of the seat should be in the same perpendicular line. This will not allow the scholar to stand up in front of his seat; but if the seats and desks are single, he can stand on one side of the seat. If the seats and desks are designed for two scholars, then the corner of each scholar's seat may be cut off, as in the representation below.



Here each scholar can stand up in the corner *a*, or sit upon the seat *b*.

In regard to the height of the seats, it is common to give exact measurements. But inflexible rules will never fit varying circumstances. Some schoolrooms are for females; others for boys only. In factory villages, usually, a great proportion of the scholars are young; while, in one county in the State, great numbers of the males attending school, during the winter term, are more than sixteen years of age. To follow unvarying rules, therefore, would aggrieve as many as it would accommodate. But the principles to be observed are few, and capable of a definite exposition. A live child cannot be expected to sit still, unless he has a support to his back, and a firm resting-place for his feet. As a scholar sits upright in his seat, the knee joint forming a right angle, and the feet being planted horizontally on the floor, no pressure whatever should come upon the thigh bone where it crosses the edge of the seat. If obliged to sit upon too high a seat, a foot-board or block should always be provided for the feet to rest upon. Children sometimes go to school at an age when many of their bones are almost as limber as a green withe, when almost any one of the numerous joints in the body may be loosened or distorted. They go almost as early, as when the Chinese turn their children's feet into the shape of horses' hoofs; or when some tribes of Indians make their children's heads as square as a joiner's box. And, at this period of life, when portions of the bones are but little more than cartilage, and the muscles will stretch like sheep's leather, the question is, whether the seats shall be conformed to the children, or the children shall be deformed to the seats. I wish to fortify myself on this subject, by making a few extracts from a lecture on Physical Education, by that celebrated surgeon, Dr. John C. Warren. "When children are sent to school, care should be taken, that they are not confined too long. Children under fourteen should not be kept in school more than six or seven hours in a day; and this period should be shortened for females. It is expedient, that it should be broken into many parts, so as to avoid a long confinement at one time. Young persons, however well disposed, cannot support a restriction to one place and one posture. Na-

* Mr. Alcott's Prize Essay may be found at the end of the second volume of the Lectures, published by the American Institute of Instruction, in 1831, and is a very valuable paper.

ture resists such restrictions ; and if enforced, they are apt to create disgust with the means and the object. Thus children learn to hate studies, that might be rendered agreeable, and they take an aversion to instructers, who would otherwise be interesting to them.

"The postures they assume, while seated at their studies, are not indifferent. They should be frequently warned against the practice of maintaining the head and neck long in a stooping position, and the disposition to it should be lessened by giving a proper elevation and slope to the desk, and the seat should have a support or back.

"The influence of an upright form and open breast has been sufficiently explained ; and what may be done to acquire these qualities, is shown by many remarkable facts, one of which I will mention. For a great number of years, it has been the custom in France to give to young females of the earliest age, the habit of holding back the shoulders, and thus expanding the chest. From the observation of anatomists, lately made, it appears that the clavicle or collar bone is actually longer in females of the French nation, than in those of the English. The French have succeeded in the development of a part, in a way that adds to health and beauty, and increases a characteristic, that distinguishes the human being from the brute.

"While all of us are desirous of possessing the excellent qualities of strength, hardiness, and beauty, how defective are our own systems of education in the means of acquiring them.

"In the course of my observations, I have been able to satisfy myself, that about half the young females, brought up as they are at present, undergo some visible and obvious change of structure ; that a considerable number are the subjects of great and permanent deviations ; and that not a few entirely lose their health from the manner in which they are reared.

"I feel warranted in the assertion, that, of the well-educated females, within my sphere of experience, about *one half are affected with some degree of distortion of spine.*

"The *lateral* distortion of the spine is almost wholly confined to females, and is scarcely ever found existing in the other sex. The difference results from a difference of habits during the school education. The immediate cause of the lateral curve of the spine to the right, is the elevation and action of the right arm in drawing and writing."

Much more might be quoted, apposite to this important subject. It seems only necessary to add, that nothing so essentially tends to aggravate these evils, as the want of a proper resting-place for the feet. Let any man try the experiment, and see how long he can sit in an upright posture, on a narrow bench or seat, without being able to reach the floor with his feet, and consequently with the whole weight of his feet, boots, and the lower parts of the limbs, acting with the power of a lever across the middle of the thigh bones. Yet, to this position, hundreds of children in this State, are regularly confined, month after month ; and while condemned to this unnatural posture, Nature inflicts her punishments of insupportable uneasiness and distress on every joint and muscle, if they do sit still, and the teacher inflicts his punishments, if they do not. A gentleman, extensively known to the citizens of this State, for the benevolence of his character, and the candor of his statements, who, for the last twenty years, has probably visited more of our Common Schools, than any other person in the State, writes to me as follows : "I have no hesitation in repeating what I have often publicly declared, that, from the bad construction of our schoolhouses, there is more physical suffering endured by our children in them than by prisoners in our jails and prisons."* The following is an extract of a letter, addressed to a '*Common School Convention*,' held at Northampton in

* The Rev. Gardiner B. Perry, of Bradford.

February, 1837, by Dr. Joseph H. Flint, of that place: "For want of attention to the subject," (the construction of schoolhouses,) "I have the means of knowing, that there has been annually loss of life, destruction of health, and, in numberless instances, anatomical deformities, that render life hardly worth having. In the construction of schoolhouses, there are many considerations, involving the comfort, and health, and life, of the young," &c.

I am informed by surgeons and physicians, that a pupil, when writing, should face the writing-desk squarely. This position avoids all unequal lateral pressure upon the spinal column, and of course all unequal tension of the muscles on either side of it. It also interferes least with the free play of the thoracic viscera, which is a point of great importance. The edge of the desk should then be an inch or two above the bend of the elbow, as the arm hangs nearly by the side. Any slight want of exact adjustment can be corrected, by extending the elbow further from, or bringing it nearer to, the body.

The height of the seats and desks should of course be graduated, to fit the different sizes of the scholars; the smallest scholars sitting nearest the teacher's desk.

The arrangement of seats without desks, for small scholars, when needed, is too obvious to require any explanation. Their proper position will depend upon the other arrangements of the schoolroom. Long benches, having separate chair-shaped seats, but with a continuous back, are sometimes used.

The place for hanging hats, bonnets, and so forth, will also depend upon the general construction of the house. It should be such as to encourage habits of neatness and order.

The instructer's desk should be upon a platform, raised so high as to give him a view of the persons of the pupils above their desks. When the school is not large, it should be at the end of the room. It should overlook the play-ground. Cases for the deposit and preservation of the apparatus and library, should be near the desk, except where a separate apartment is provided. A teacher without apparatus,—however numerous may be his books,—is like a mechanic with but half a set of tools.

The average number of scholars in the schools in Massachusetts, is about fifty. When the school is large, there should be a separation of the older from the younger children, and the latter, at least, placed under the care of a female teacher. The opinion is almost universal, in this State, that female teaching for young children is, in every respect, superior to male. If the number of the older scholars be large, there should be a separate recitation-room, and a door and an entry for the entrance and accommodation of each sex.

In very large schools, it may be thought expedient to have desks, sufficiently long to accommodate six or more scholars, with chairs, fastened to the floor, for seats, and a space between the chairs and the next tier of desks, for passing in and out. In such cases, the desks may be placed longitudinally, and the teacher's platform for himself and assistants, extend the whole length of the room, in front of them.

I now come to a subject, which I think of primary importance. It is the almost universal practice of teachers to call their classes out upon the floor for reading and recitation. If there were no other reason, the change of position it gives them, is a sufficient one. The seats in schoolrooms, are, almost without exception, so arranged, that these proceedings take place in full view of all the scholars; and they are often so, that when the teacher turns his face towards the class, he must turn his back upon the school. The idle and disorderly seize upon such occasions to violate the rules of the school. This, they can generally do, with perfect impunity. They can screen

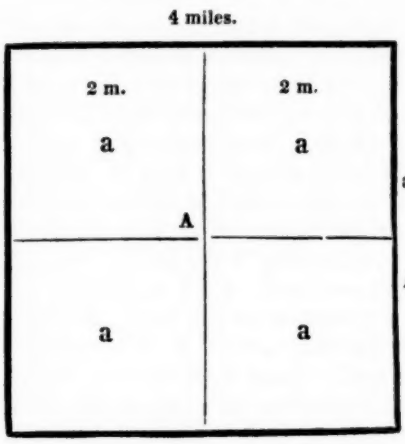
themselves from observation, by moving the head so that an intermediate scholar shall intercept the teacher's view ; or by holding up a book, slate, or atlas before themselves, and under such shield, can whisper, eat, or grimace. But the effect upon the attentive is worse, than upon the idle ; and its tendency is to turn the former into the latter. The eye is the quickest of all the senses, and the minds of children always yield instant obedience to it, and follow wherever it leads. Every one must have observed, that when a class is reciting in presence of a school, if any thing unusual or incongruous transpires, such as the falling of a book or slate, or the ludicrous pronunciation of a word, the attention of every scholar is broken off from his study. The blunder or stammering of a four years' old child, learning letters, will strike every hand in the school off its work. While the senses, and especially the eye, are bringing vivid images to the mind, it is almost impossible for men, and quite so for children, to deny them access. Much of what the world admires as talent, is only a power of fixing attention upon an object, and of looking steadily at it until the whole of it is seen. The power of concentration is one of the most valuable of intellectual attainments, because it is the principal means of achieving any other ; and the pupil, with but little positive knowledge, in whom this has become a habit of mind, has a far higher chance of success in any walk of life, than one with a thousand times the knowledge, but without the habit. This power is an acquired one as much as any other ; and as susceptible as any other of improvement. But overtasking destroys it, just as overloading the limbs crushes, instead of strengthening them. Reference must be had, therefore, to the ordinary powers of children's minds, or we shall have distraction instead of abstraction. Much fixedness of thought, ought not to be expected from the giddiness and volatility of children. In rooms of the common construction, I do not believe that more than one-half of the time is available for study. Not only, therefore, ought the desire of strengthening this power to be inspired, but the arrangement of the room and the tactics of the school should be made to contribute, unconsciously to the children, to the same effect. Although the habits of the mind are the main thing to be regarded in education, yet it cannot be denied that one hour of concentrated attention on any subject, is worth more than a week's listless hovering and floating around it. Hence, where there is no separate recitation-room, (which, however, every large school ought to have,) the area for that purpose, should be behind the scholars who remain in their seats. The teacher can then take such a position at the end of the room, opposite his desk, as to command at once, a view of the reciting class and the rest of the school. He will then see, without being seen. The scholars can interpose nothing between themselves and him. Every scholar would be convinced, by strict vigilance on the part of the teacher, during the first week of the school, that he had no power of violating rules without detection. They would, therefore, yield to the necessity of the case. The temptation would die with the opportunity to gratify it. The ear only of the scholars would be solicited to notice the voices behind them, while the stronger attraction of visible objects, the book, the slate, the map, would rivet eye and mind upon the subjects of study. This slight interruption in the rear, while the mind enjoyed such advantages for overcoming it, would increase its power of continuous attention, and enable it, in afterlife, to carry on processes of thought in the midst of conversation or other disturbing occurrences. Still, it is thought, that the teacher's desk should always face those of the scholars ; so that when a class recites in the seats, when the whole school joins in any exercise, or when they are to be addressed, each party should be able to see the other face to face. The social principle will never, otherwise, flow freely.

LOCATION OF SCHOOLHOUSES.

All philosophers agree that external objects affect temper and character. If their influences are imperceptible, the results will be so much the surer, because imperceptible influences are never resisted. Because children cannot analyze and state in propositions the feelings, which outward circumstances breathe into their susceptible minds, it is no proof, that they are not undergoing insensible changes. Every body recognises the silent influences of external nature, if exerted only for a few days, in the case of those religious sects, who use the forest for a temple. Fatal contagions enter through the skin or lungs, without sending forward any herald. Subtile influences upon such delicate tissues as the nerves and brain are not seen in the process, but only in the result. But experience and reason enable us to foresee such consequences, and, foreseeing, to control them. Adults alone can perform such a duty. If they neglect it, the children must suffer.

It has been often objected to the people of our State, that they insist upon having the schoolhouse in the geographical centre of the district. And, other things being equal, surely it ought to be in the centre. But the house is erected for the children, and not for the acres; and the inconvenience of going fifty or even eighty rods further is not to be compared with the benefit of spending a whole day in a healthful, comfortable, pleasing spot,—one full of salutary influences upon the feelings and temper. Place a schoolhouse in a bleak and unsheltered situation, and the difficulty of attaining and preserving a proper degree of warmth is much increased; put it upon a sandy plain,—without shade or shelter from the sun, and the whole school is subjected to the evils of heat and dust; plant it in low marshy grounds, and it exposes to colds or to more permanent diseases of the lungs, and impairs habits of cleanliness both in dress and person; make one side of it the boundary of a public road, and the persons of the children are endangered by the travel, when out, and their attention, when in, called off the lesson by every passer by; place it on a little remnant or delta of land, where roads encircle it on all sides, without any place of seclusion from the public gaze, and the modesty of nature will be overlaid with habits of indecorum; and a want of decency, enforced upon boys and girls, will become physical and moral turpitude in men and women. But build it, where some sheltering hill or wood mitigates the inclemency of winter; where a neighboring grove tempers the summer heat, furnishing cool and shady walks; remove it a little from the public highway, and from buildings where noisy and clattering trades are carried on; and, above all, rescue it from sound or sight of all resorts for license and dissipation, and a sensibility to beauty, a purity of mind, a sentiment of decency, and propriety will be developed and fostered, and the chances of elevated feelings and correct conduct in afterlife, will be increased manifold. Habits of mental order and propriety are best cherished amidst external order and propriety. It is a most beautiful trait in the character of children, that they take the keenest delight in the simplest pleasures. Their desires do not tax commerce for its luxuries, nor exhaust wealth for its embellishments. Such pleasures as are imparted by the cheerful light and the quickening air, by the wayside flowers, the running stream, or the music of birds, are sufficient for the more gentle and pensive; and the impetuous and exuberant of spirit only want a place to let off the redundant activity of their arms and legs. And how cheaply can these sources of gratification be purchased! Sometimes a little of the spirit of compromise; sometimes a little forgetfulness of strifes among the parents, engendered on other subjects, would secure to the children the double boon of utility and enjoyment. Yet how often are the unoffending children ground between the collisions of their parents!

It seems not unconnected with this subject to inquire, whether, in many places out of our cities, a plan may not be adopted to give greater efficiency to the means, now devoted to common-school education. The population of many towns is so situated as conveniently to allow a gradation of the schools. For children under the age of eight or ten years, about a mile seems a proper limit, beyond which they should not be required to travel to school. On this supposition, one house, as centrally situated as circumstances will permit, would accommodate the population upon a territory of four square miles, or, which is the same thing, two miles square. But a child above that age can go two miles to school, or even rather more, without serious inconvenience. There are many persons, whose experience attests, that they never enjoyed better health, or made greater progress, than when they went two miles and a half or three miles, daily, to school. Supposing, however, the most remote scholars to live only at about the distance of two miles from the school, one house will then accommodate all the older children upon a territory of about sixteen square miles, or four miles square. Under such an arrangement, while there were four schools in a territory of four miles square, i. e. sixteen square miles, for the younger children, there would be one central school for the older. Suppose there is $600 to be divided amongst the inhabitants of this territory of sixteen square miles, or $150 for each of the four districts. Suppose further, that the average wages for male teachers is $25, and for female $12.50, per month. If, according to the present system, four male teachers are employed for the winter term, and four female for the summer, each of the summer and winter schools may be kept four months. The money would then be exhausted ; i. e. four months summer, at $12.50 = $50, and four months winter, at $25 = $100 ;—both = $150. But according to the plan suggested, the same money would pay for six months, summer school, instead of four, in each of the four districts, and for a male teacher's school eight months, at $35 a month, instead of four months, at $25 a month, and would then leave $20 in the treasury.



Territory four miles square, or of sixteen square miles.

a. a. a. a. District schoolhouses for female teachers.

A. Central schoolhouse for a male teacher.

By this plan, the great superiority of female over male training, for children under eight, ten, or twelve years of age, would be secured ; the larger scholars would be separated from the smaller, and thus the great diversity of studies and of classes in the same school, which now crumbles the teacher's time into dust, would be avoided ; the female schools would be lengthened one half ; the length of the male schools would be doubled, and for the increased compensation, a teacher of fourfold qualifications could be employed. Undoubtedly, in many towns, upon the Cape or among the mountains, the course of the roads and the face of the territory would present insuperable obstacles to the full reduction of this scheme to practice.

But it is as unquestionable, that in many others no physical impediments exist to its immediate adoption; especially, if we consider the legal power of different towns to unite portions of their territory for the joint maintenance of schools. We have not yet brought the power of united action to bear with half its force upon the end or the means of education. I think it will yet be found more emphatically true in this department of human action, than in any other, that adding individual means multiplies social power. If four districts cannot be united, three may. If the central point of the territory happen to be populous, a schoolhouse may be built, consisting of two rooms; one for the large, the other for the small scholars; both upon the same floor, or one above the other. It ought to be remarked, that where there are two schoolrooms under the same roof, care should be taken to have the walls well deafened, so that neither should ever be incommoded by any noises in the other.

The above enumeration of requisites in a schoolhouse is considered absolutely essential and indispensable. Just so far as they are disregarded, that nursery for the rearing of vigorous, intelligent, and upright men, must fail of its object. If the children's lungs are fed only with noxious and corrupted air, which has once performed its office, and is, therefore, incapable of performing it again, without renovation, it may generate positive and incurable disease, and impair the energies both of body and mind for the residue of life. "In looking back upon the languor of *fifty years* of labor as a teacher," said the venerable Mr. Woodbridge, "reiterated with many a weary day, I attribute a great proportion of it to *mephitic air*; nor can I doubt that it has compelled *many worthy and promising teachers* to quit the employment. Neither can I doubt that it has been *the great cause* of their subsequent sickly habits and untimely decease." People, who shudder at a flesh-wound and a trickle of blood, will confine their children like convicts, and compel them, month after month, to breathe quantities of poison. It would less impair the mental and physical constitutions of our children, gradually to draw an ounce of blood from their veins, during the same length of time, than to send them to breathe, for six hours in a day, the lifeless and poisoned air of some of our schoolrooms. Let any man, who votes for confining children in small rooms and keeping them on stagnant air, try the experiment of breathing his own breath only four times over; and, if medical aid be not at hand, the children will never be endangered by his vote afterwards. Such darkening and benumbing of the mind accustoms it, in its first beginnings, to look at objects, as it were, through a haze, and to seize them with a feeble grasp, and robs it of the pleasure of seeing things in a bright light. Children always feel a keen delight in the consciousness of overcoming difficulties, and of fully comprehending any subject. This pleasure is the most legitimate of all rewards, and one which Nature always pays down on the spot. But, instead of this, after filling their brains with bird-lime, we taunt or chastise them, if they stick or get posed. If a child suffer from heat or cold, from a constrained or unnatural position; if his attention be perpetually broken off by causes beyond his control; it tends to make his temper fretful and irritable, and compels him to go back, again and again, to the beginning of his problem or exercise, like a traveller obliged to return home and commence his journey anew after having completed half its distance.

(To be continued in our next Number.)

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